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Court-room Furniture
Competitive Designs for Medals to be Awarded at the Cincinnati Architectural Exhibition.
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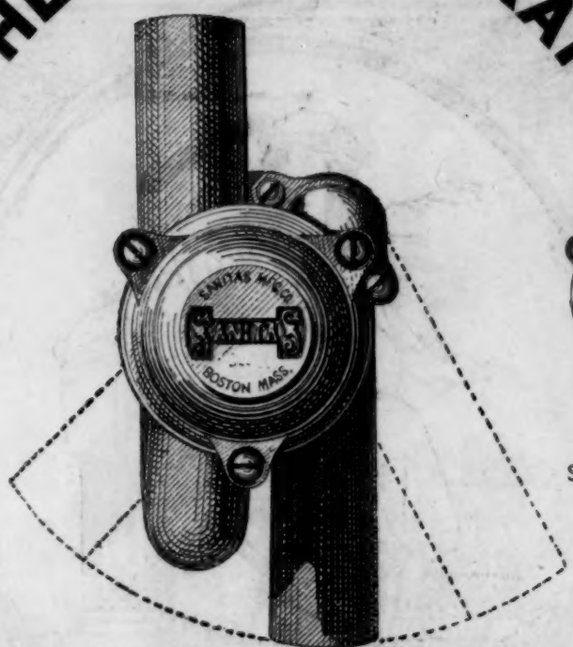

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A DISCUSSION has lately been going on in *La Semaine des Constructeurs* about the responsibility of a builder or architect for defects in a building which come from following out the directions of the owner. It often happens, as we all know, that owners insist on following out their own whims, or the suggestions of their friends, in a way which is injurious to the stability of the structure on which they exercise their talent, and both architects and builders, knowing how hopeless it generally is to try to reason an owner out of a fancy in regard to a building, usually, as they say, "throw the responsibility on him," and quietly carry out his wishes with as much regard to safety and strength as practicable. We have before pointed out that, according to our law, this practice is highly dangerous for architects, and the French examples show that it is equally so abroad. According to a decision of the Fourth Chamber of the Court of Paris, dated November 8, 1886, it appears that if the owner of a building, being of mature age and capable of contracting, gives positive orders to have the work done in a certain way, the architect and builder, if they protest against these orders and refuse to carry them out, and only consent subsequently to do so on receiving a formal discharge, signed by the owner, from all responsibility for the consequences, are, by this refusal of obedience and subsequent discharge from responsibility, protected against pursuit by the owner on account of damage to his property resulting from carrying out his orders; but that even this does not release them from penal responsibility in case accident or injury to persons should result from executing the injudicious directions of another. As the owner undoubtedly has the right to discharge an architect who does not carry out his wishes, it will be seen that in this case, as in so many others, the architect has to steer with superhuman sagacity between rocks and whirlpools on both sides of his course. Just how threatening is the reef which threatens him on one side may be inferred from a still later French case. Three or four years ago, two builders, A & Son, constructed a house for Mr. B, who made his own plans and supervised the work. All the dimensions of walls, and so on, were given by Mr. B himself, who, moreover, ordered that the walls should be laid in lime-mortar, instead of cement. The house was hardly finished when it fell down, and the proprietor, as usual with such men, demanded that the builders should make good the loss. They refused, and, in the suit which followed, the Court of Aix, by decision of January 4, 1887, decided that as the builders had simply carried out the formal instructions of the proprietor, they were not responsible for the consequences. The case was appealed to the Court of Cassation, and by decree of October 23, 1888, the decision of the court below was reversed. The higher court held that "It is not sufficient, to avoid the responsibility of a constructor, to establish that he only carried out the plans, specifications and instructions of the proprietor. The architect or builder must *absolutely refuse* to execute the work entrusted to him under conditions which may compromise its solidity. By accepting these conditions, he adopts as his own the plans and specifications, and assumes, in consequence, the responsibility which the law lays upon him." This important decision, which, judging from cases here, we think would be fully sustained in our own courts, renders only too evident the folly of those complaisant architects and builders who will do anything that a meddling, fussy owner wishes for the sake of avoiding a quarrel with him. In no country is the profession of architecture so little esteemed as here, and in no country are architects and builders so injured, as well as tormented, by owners who think themselves capable of laying out and supervising their own buildings. We have hundreds of such owners, who go to an architect of reputation to "make them a sketch for a front," or "draw out their idea," and to a responsible builder to "do their work just as they want it done," and the architect of reputation and the responsible builder do what is asked of them, and then, as they suppose, wash their hands of the matter, never dreaming that each of them has made himself responsible for all the consequences of the owner's ignorance, folly or parsimony. There have been scores of cases here where the application of this principle of law, if the owner had thought of it, would have robbed architects and builders, of high and deserved reputation, of their last dollar, and a few conspicuous lessons of the kind may be needed before our architects and builders demand and take the position which the law gives them, that of men of science, who, in constructing buildings, are carrying out works of high technical difficulty, in which they have no right to excuse themselves for malpractice on the ground that they subjected their superior knowledge to the directions of an unskilled person, even though that person may have been the owner. A doctor would not be excused for poisoning a patient on the ground that the patient wanted him to administer strychnine instead of quinine, even though strychnine might be cheaper than the other medicine; and if architects and builders would remember that by being connected in any way, either by positive orders or not, with ill-considered plans, doubtful foundations, defective materials, careless or unskilful workmen or tricky contractors, they incurred frightful danger, and would act accordingly, they would find that instead of less, they would have more employment, and that their work would be far more satisfactory and profitable.

A CONCRETE floor fell recently in Berlin under curious conditions. In repairing the roof of a large military stable, it was decided to cover the building entirely with concrete, "after the Italian manner." A wire skeleton was prepared in the form of a series of vaults, which was to be covered with concrete, and, to prevent the concrete from falling through the meshes of the wire while soft, boards were put up beneath it, following the form of the vault. After the concrete had had three days to harden the boards were removed; but something seems to have interfered with the setting, for, on removing a certain portion of the boarding, the concrete over it fell for a space twelve or thirteen feet long, striking the workmen engaged under it, and severely injuring three of them.

THE Administration of the Paris Exhibition has been very liberal of its recompenses to the architects who showed their work. Besides such men as Waterhouse, Garnier, Vaudremer, and so on, who, being on the jury, were excluded from competition, grand prizes were awarded to Mr. Collcutt, of England, architect of the new Imperial Institute, Mr. Norman Shaw, M. Schadde, of Belgium, and MM. Chipiez, Formigé, Daumet, Ginain, Lheureux and Paulin, of France. Gold medals were awarded to many distinguished French architects, and to Messrs. Douglas & Fordham, and Webb & Bell, of England; and silver medals to William Emerson, the author of the most noted design for the Liverpool Cathedral, and two other English architects. No recompense was awarded to any American architect, probably for the simple reason that none exhibited.

THE newest thing in school-houses comes, as usual, from Germany. Not content with the provision of a gymnasium for every school-house, as is now the law in Switzerland and most parts of Germany, the new public schools in Weimar and Göttingen are furnished with baths for the pupils. In that at Weimar, the baths are placed in the basement, in vaulted rooms, plastered with smooth cement, and floored with asphalt, over which is a lattice platform of wood; and places for hanging clothes are provided near. The baths consist of showers, supplied with hot and cold water, under each of which is a round zinc dish, large enough to accommodate three children. There are seven of the showers, so that twenty-one pupils can be bathed at once, and the entire school thus washed up very expeditiously. Considering that the scholastic bath is probably the first and only one which most of the pupils ever undergo, there is certainly an advantage in giving them an opportunity for one such experience. In our hot climate, particularly, a tri-weekly shower-bath all around for the scholars of city schools would conduce immensely to their health and comfort, but it would probably need German absolutism to induce their parents to consent to what thousands of them believe to be a dangerous and unnatural experiment.

THE *Bautechnische Zeitung*, in answer to a correspondent who inquires for a formula for determining the thickness of walls, gives Rondelet's rule, which it declares to be still the best, and adds some observations of its own, which are of value. Most of our readers probably know Rondelet's rule, by which, as given in his book, the height of the proposed wall is to be drawn, at any scale, as a vertical line, and its length, between cross-walls or buttresses, on a horizontal line, drawn from the foot of the vertical. For "medium stability," the vertical is then to be divided into ten equal parts, and with one of these parts as a radius, and the top of the vertical as a centre, an arc is to be drawn; the top of the vertical, and the farther end of the horizontal line, are then to be connected by a diagonal line, and a second vertical is to be drawn through the point where this diagonal intersects the arc drawn just previously. The space intercepted between the first and second verticals will represent the proper thickness of the wall at the given scale. The same result is arrived at algebraically by solving the equation $T = \frac{L\,H}{n\sqrt{L^2 + H^2}}$, T being the thickness required, L the length of the wall between cross-walls or buttresses, H the height, and n a constant, which will be 10 for a brick wall of reasonable stability. Extending this formula to cover walls of other materials, the *Bautechnische Zeitung* finds that with perfectly cut stone — the "ashlar" of the English masons — the wall may safely be thinner than with brick, so that n may in this case be taken at 12. With split-stone the wall must be thicker, n being not more than 8, and for rubble it should be 6, or even less. If walls are exposed to strong winds, they should be thicker, especially if long, than in sheltered situations, and a wall laid with inferior mortar should be thicker than one in cement.

THE destruction by rust of two of our great ironclad ships, which were recently found with their hulls corroded entirely through, calls to mind an ingenious application of voltaic electricity, by which the English ironclads are now successfully protected. Taking advantage of the fact that when a battery is formed of iron and zinc in a corroding solution, the zinc is most readily acted upon, many of the later ships have their iron hulls cased with boards, over which are nailed sheets of zinc. At intervals, through holes in the boards, connection is made between the two metals. On exposure to the action of sea-water, it is found that the zinc is dissolved away, and must be periodically replaced, but so long as any zinc remains, the iron under it is perfectly protected against rust, by the transfer of the chemical action to the zinc. According to *Le Génie Civil*, zinc is also rapidly taking the place of copper for sheathing wooden ships. Although much more readily corroded in the air, it is found that, when submerged in sea-water, zinc will last at least as long as copper, while it costs only about one-fourth as much. The same article gives a curious account of the early manufacture of zinc. It seems that, although the various ores have been in use since very ancient times, the metal was only discovered in 1806, and the discovery was made in obedience to an order from the first Napoleon. Since the Middle Ages, the mines of Vieille-Montagne, in Belgium, had furnished calamine, a native oxide of zinc, which was used for making brass, by heating copper, calamine and charcoal together in crucibles. On the annexation of the Belgian provinces to the Republic of France, in 1795, the Vieille-Montagne mines were appropriated by the Government, and worked, with very indifferent success, until 1806, when the Emperor handed them over to a Belgian chemist, Daniel Dony, under a concession which made it obligatory on him to endeavor to extract from the calamine the metallic base which it was suspected to contain. As zinc is very volatile, all Dony's attempts to reduce it from the ore by melting with charcoal and fluxes in crucibles proved unsuccessful, for the reason that the zinc flew, unobserved, up the chimney as fast as it formed in the crucible. After trying in vain to do what the Emperor required of him, Dony finally determined to arrange a reverberatory furnace, in which he could raise the mass in the crucible to a temperature higher than any he had previously attained, thinking that if he could only get it hot enough, he might still succeed. When all was ready, in order to be able to see what was going on in the furnace, he made a hole in the side of the cupola, and inserted a flower-pot, with the rim inward, so that he could use the hole in the bottom of the pot as a loophole for observation. The fire was kindled, and, as before, the zinc, when it became hot enough, began to fly up the chimney, but, on the way, some of the fumes drifted into the flower-pot, which, being exposed to the air, was cooler than the rest of the furnace, and there condensed, and Dony, on looking through the hole, to see if there was any appearance of metal in the crucible, was amazed to find drops of melted zinc trickling down the sides of the flower-pot, close to his nose. The mystery being thus solved, the distillation of zinc from the ore became an easy process, and, even yet, the list of purposes to which this cheap and useful metal can be put is by no means exhausted.

THE Eiffel tower was struck by lightning the other day, and the scientific observers who were stationed for various purposes in the tower had an excellent opportunity for studying that sort of phenomenon on the spot. The summit of the tower is protected by a lightning-rod, with a heavy point of bronze, tipped with platinum, and eight other points project obliquely from the level of the third platform. The upper point had shown signs of a dangerous vibration in high winds, and had been removed, leaving the end of the rod, with only the screw-threads cut on it, projecting above the top of the tower. About ten o'clock one evening, while the managers of the electric-lighting were busy about the enormous groups of arc lights placed in the top of the tower, a terrific clap of thunder was heard, and the lightning was seen from the outside to strike the summit, while, at the same instant, as well as repeatedly afterward, crackling sounds, accompanied with streams of light, were perceived around the undisturbed points at the gallery level. The people in the tower experienced no shock or inconvenience of any sort, but those standing outside on the galleries thought it prudent to get inside without delay. Immediately after the lightning, a cloud descended around the upper portion of the tower, and, being strongly illuminated by the huge arc-lamps, gave persons in the neighborhood the idea that the top of the structure was encompassed with electric flames, which, as was reported, "surpassed in brilliancy the lamps themselves." At the instant of the flash, red sparks were seen to fly from the tip of the upper conductor, and, on examination, it was found that the screw-threads were in places partly obliterated, apparently by melting, and it was necessary to restore them with a file before the point could be screwed on again.

A NEW artificial stone is coming into use in Germany, which, instead of the dull, darkish gray inseparable from the compounds of Portland cement, is almost perfectly white, being made of white sand and a new white cement. What this white cement is composed of we can only conjecture. It may possibly have magnesia in its composition, like some other strong white cements; but, however that may be, it seems likely to be useful. The greatest objection to the artificial stones made of Portland cement has hitherto been their color, and a stone equal to them in hardness, and of a white or light color, is much to be wished for.

EQUESTRIAN MONUMENTS.[1]—XXII.

JOAN OF ARC.

Campanian Horseman found near Capua. After Menard's "*La Vie Privée des Anciens.*"

THE possession of a fine artistic conscience, so to call it, must be considered one of the attributes of an artist of high rank, and if Emmanuel Fremiet had no other claim to a high place in the ranks of sculptors, whether ancient or modern, an undertaking which he has this year accomplished should surely make good any pretensions he or his friends might put forward.

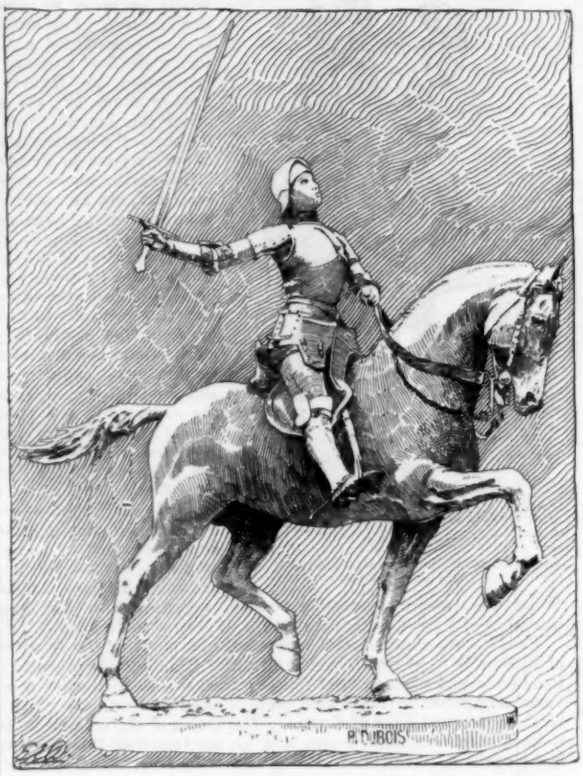
Holding an honored place in the Paris Exhibition this year may be seen a full-size cast of an equestrian statue of the Maid of Orleans, which has a familiar air to all lovers of statuary who see it — so familiar that the less observant probably wonder how it is that a cast of a comparatively old and well-known equestrian group finds a place in an exhibition which is supposed to illustrate only the advances that manufacture, science and art have made during the last decade. These observers, of course, imagine that the group before them is only a replica of the famous statue of Joan of Arc in the little Place des Pyramides, just off the Rue de Rivoli in Paris, where it is seen by every visitor to that city. Occasion has already been taken to speak of this group in the Place des Pyramides as, in many ways, the most satisfying piece of equestrian sculpture, after the "Colleoni" at Venice, that has been produced since the days of the ancients. But the very fact that it is so good has made it the target of a great

New Model of Joan of Arc. E. Fremiet, Sculptor.

deal of criticism, and apparently the sculptor has found that in some things the critics were in the right, and has come to feel that there were points in which his original conception was defective. Feeling thus, Fremiet, though long past the prime of life, found that he could not believe himself a true artist if he did not do something to rectify his errors, and so determined to undertake at his own expense and of his own volition the laborious task of remodelling the entire group.

[1] Continued from page 173, No. 720.

If he had frankly abandoned his original conception and set out to create one entirely different from it, the undertaking would have been hardly more notable than if he had set about producing a statue of some personage he had never modelled before. But this was not the case: he was satisfied with the original conception; the manner in which he had given it expression was what caused him discomfort. Consequently, his task involved a vast amount of drudgery, which had to be undertaken for the sake of securing the new expression he



Joan of Arc for Rheims. P. Dubois, Sculptor.

sought, which could only be added in the final stages of the work. These changes are so little obvious, so subtile, that it is not to be wondered that most observers are unconscious that they exist; and yet, should the old and new statues be placed side by side, they would be detected easily enough.

Bastien-Lepage's wondrous painting of Joan of Arc, for a long time at the Boston Museum of Fine Arts, and now in the Metropolitan Museum in New York, has taught us how powerfully a story may be told by the intensity and quality of facial expression, and it was mainly to secure this quality that Fremiet's new model was undertaken. The Joan of the original statue represents a girl of the right age, of the proper social class, and possessed with a determination to carry out her aims; but it is just here that the original falls short of satisfying the ideal. The determination which the statue evinces is one created by external circumstances. Joan is represented here as a girl who has seen with the eyes of the flesh certain wrongs inflicted by a higher human power upon her neighbors and fellow-beings of the same class, and the ordinary instincts of a courageous human being, whether male or female, have induced her to champion the cause of her down-trodden fellows. The quality of intellectual inspiration, so conspicuous an element in Bastien-Lepage's painting, is wholly unexpressed, and it was almost entirely for the sake of giving expression to the internal promptings of a mind affected by a devout superstition that Fremiet found it worth while to devote so much time and labor as the execution of the new model involved. The addition of the frontlet to the horse and the few minor changes in the modelling of the animal may or may not give an added value to the whole, but few can fail to appreciate the fact that the severe and absorbed countenance of the new Joan is a better interpretation of character than the face of the plump and jocund little girl of the original group, with her features puckered into as close an approximation of grim determination as the habitual good nature of the French peasant will allow.

It is not unnatural that Fremiet should have gone slightly wide of reaching the fullest expression of his conception, for, as a sculptor whose specialty is the modelling of animals — and he is known as the greatest *animalier* of modern times, he was probably more occupied in giving expression to the horse than intent on revealing the workings of the inner spirit in the countenance of the rider. Other sculptors who have taken Joan of Arc for a subject have been

more observant of the desirability of giving greater expression to the legend which asserts that Joan was affected by a divine inspiration, and a chief part of their endeavor has been to typify the devotional attributes of her character. At the Paris Exhibition is also shown a cast of another equestrian statue of Joan of Arc, by Paul Dubois, who has taken especial care to signalize the devotional side of Joan's nature by the character of expression with which he seeks to inform her features. The maiden is here represented not as feeling the first pressure of inspiration, as Bastien-Lepage shows her, and not under the impulse toward the physical accomplishment of her purpose, as Fremiet, in his earlier statue, represents her, but as under the influence of a calm and devout satisfaction at the accomplishment of the task which she had imposed upon herself. With eyes upcast she returns thanks to God, or seeks the applause of spirits above her that other earthly eyes cannot see. But for all that, and for all the care, skill and painstaking the sculptor has bestowed on his task, he has given us not the Joan of history, but a meek-spirited and gentle-faced nun masquerading in armor and flourishing a large sword in the most meaningless and helpless manner. What the precise connection of such a gesture with the dumb utterance of a pæan of thanksgiving is, it is hard to discover.

Wooden Statuette of Joan of Arc in the Musee de Cluny, Paris.

This statue, whose execution was brought about by the Academy of Rheims, is to be set up in that city as a tribute to the memory of the heroic girl who captured the city from the English after many years' occupation by them, and made it possible for Charles VII to be there crowned King of France. The choice of the sculptor seems to have been somewhat determined by the fact that the Academy had learned that Dubois had long had it in mind to model such a statue, had done some preliminary work on it, and was only waiting the encouragement of a definite commission to go on with it.

Bronze Statuette of Joan of Arc in the Collection Odiot. From the *Gazette des Beaux-Arts.*

While it is not fair to argue that the sculptor erred in arming Joan with a sword, since the myth has it that she was provided with a sword of mystic powers—the sword of Fierbois, whose hiding-place was revealed to her in a vision—yet she herself often said that she loved her standard "forty times more than her sword," since her woman's might flourished it with more ease than the homicidal weapon, and it did far more to inspire her followers. For a statue that was to be set up in Rheims, the standard in her hand would have had peculiar significance, since one of the counts in the indictment on which she was tried at Rouen recited that she had dared to carry her standard into the cathedral and hold it upright at the side of the high-altar during the ceremony of crowning the dauphin. Possibly the reason that Dubois displaced the standard in favor of the sword was to differentiate as much as possible his work from Fremiet's.

Earlier sculptors recognized the close association between Joan and her oriflamme, and, though the wooden statuette in the Musée de Cluny holds neither sword nor staff, the position of the right arm is evidence that this earlier and probably contemporary piece of sculpture showed Joan carrying her long and narrow white pennon, blazoned with the Deity between kneeling angels, and the words "Jhesus Maria" on one side, and on the other side the arms of France on a ground strewn with *fleurs de lis.* This statuette is painted, the horse white and Joan's armor black, relieved with gilding. It has the peculiarity that on sliding the armor over the left knee a cavity is disclosed, which is supposed once to have contained a precious relic of the Maid herself. It is unquestionably a work of the fifteenth century, and its authenticity as representing the personage whose name it bears was supposed to be beyond dispute. But recent investigations by M. Paul Quesvers make it appear that it is rather a statute of St. Maurice, chief of the Theban legion: the real history of which is as follows: The Church of Nôtre Dame et Saint-Loup de Montereau-fault-Yonne for a long time had a statuette of St. Maurice which had come to it from the Church of St. Maurice, at Montereau, which was destroyed during the Revolution. The statuette long used during processional rites had fallen into decay, so that when in 1872 a nameless jobber who had been employed in cleaning and renewing the decorations of the church refused payment, but said he would take instead the disreputable little statuette, the *curé* thought he had made a most excellent bargain. The new owner, after having cleaned and repainted the peculiar guerdon which had momentarily struck his fancy, laid it aside and thought no more of it, until one day when one of those bric-à-brac dealers who travel up and down over the face of the Continent in search of real or spurious *objets de vertu* visited him, when it was produced, and changed owners for the modest price of ten dollars. A fortnight later the dealer visited M. du Sommerard, the director of the Musée de Cluny, and for one hundred dollars sold little Saint Maurice to him as a veritable Joan of Arc, with a record of authenticity behind her which, in the eyes of the director, convinced him that he had made a wonderfully cheap purchase. Perhaps one story is as good as the other. At any rate the statuette has since then been known, and possibly always will be, as a Joan of Arc.

Joan of Arc. A. Le Veel, Sculptor.

But there is nothing that affects the credibility of the record attaching to another fifteenth-century, bronze, statuette of Joan of Arc in the collection of M. Odiot, once in the Collection Carrand,

Joan of Arc. The Princess Marie d'Orleans, Sculptor.

and here, at least, there is no question but that she bears her beloved standard, and not the sword.

The statue at Orleans, by Foyatier, is more on a plane with Dubois's than with Fremiet's work, and is less satisfactory than either, because of the ineffective and capricious pose of the horse, who is evidently more intent on selecting a nice, soft spot to roll on,

than impressed with the necessity for restraining his equine spirits until the preoccupied damsel has no further need of his services. The sculptor seeks to personify the inspired character of his subject by an upturned face, which, considering the uncertainty as to what her horse will do next, adds nothing to the restfulness of the group, and only fills the observer with anxiety as to what will befall so careless a horsewoman. The salute, which Joan seems to be executing with lowered sword-point, is a better gesture than the meaningless flourish which Dubois's figure is to sustain uncompleted for so many years.

Since writing this, news has been received that the authorities have declined to substitute Fremiet's new Joan for his earlier work, and he has, in one sense, labored in vain; but he has satisfied his conscientious scruples, and may, perhaps, take comfort in the feeling that, after all, he probably knows better than the authorities which is the better statue of the two. And he has the further gratification that the new statue has been eagerly sought by the people of Nancy, to whom he has offered it for $3,500, by a city in Lorraine, and by Philadelphia, which last is reported to have secured it, as they, the Philadelphians, had already put in a bid for the original statue, in case it should be discarded in favor of the later study. If this story be true, Philadelphia will soon be able to boast the possession of one of the best pieces of equestrian sculpture in the world.

It does not appear whether Joan contented herself solely with leading and inspiring her followers by her mere presence on the field, or whether, as she was physically a very robust young woman and at one time wore her heavy mail for six days and nights without removing it, she actually indulged in the work of the common warrior

Joan of Arc. The Count du Passage, Sculptor. From *L' Art.*

during a hot engagement: it is certain, however, that she was often in the thick of the fight, and she and her oriflamme must have been frequently singled out for special attack, as all flag-bearers always are, and consequently she was often exposed to bodily peril and received some hard knocks. It may be supposed that Le Véel selected such a moment as this as one sufficiently typical of his heroine, when he modelled the equestrian group which was first exhibited at the *Salon* of 1867, in plaster, at small scale, and again at full-size in bronze in 1880. This is not a girl merely inspired with superstitious devotion, it is no nun or sister-of-charity in armor, but a thoroughly aroused human young woman, whose helmet has been swept away by a blow, leaving her short-cut hair dishevelled, forgetful of her unfeminine surroundings, and intent only on keeping so far in the van that she shall be a lode-star to her followers struggling after. It is not a very agreeable conception, but is certainly executed with abundance of animation. It clearly shows the subject acting as a young woman of her class might be expected to act, when her blood was moving so rapidly as to drive from her mind for the moment the belief that she was acting under divine inspiration.

To the masculine mind it has seemed most important not to lose sight of the femininity of the heroine, and it has remained for a sculptor of the gentler sex to present the Maid in the guise of a warrior actually doing a warrior's work. To the Princess Marie, daughter of Louis Philippe, herself a Maid of Orleans and an artist of ability, the character of Joan appealed with peculiar force, and she modelled the heroine under several guises. One of these, a pedestrian figure, is well-known, and may be seen not only at Versailles but also at Orleans, where it stands beside the steps to the Museum. Besides this figure she modelled an equestrian statuette, which, before her death, was exhibited to only a favored few. After the death of the Princess at the recurrence of the fête day of Joan of Arc on May 3, 1855, the Queen Amélie presented a bronze cast of this statuette to the city of Orleans, and it is now placed in the museum there. The statuette is curious and interesting because of its history, and as a piece of sculpture is one which shows that the Princess might have made her mark in the ranks of artists even without the aid of birth. Joan is here shown as looking down regretfully at the body of an English soldier she has just slain, and, as becomes her in this warrior *rôle*, she bears her sword and not the standard, though her other accoutrements seem to promise inadequate protection to even a robust female amid the turmoil of hand-to-hand conflict. The horse is well rendered, and shows the agitation that a sensitive animal would naturally show at the sight of strife, and with the unwelcome scent of blood in his nostrils.

One other equestrian statue of the Maid is conceived in a somewhat similar vein, but here the sculptor seeks the aid of allegory, and preserves the femininity of his subject by making the horse the actor, and thus leaving the rider, who here again bears her standard, still removed from doing any overtly unwomanly act. In those days the arms of England showed the leopard — not the rampant lion of these later times — and the Count du Passage shows the horse trampling upon a defeated and writhing leopard, while Joan gazes upward in triumph.

JOAN OF ARC. — Joan of Arc, or more properly Joanneta Darc, afterwards known in France as Jeanne d'Arc, the Maid of Orleans, was born about 1411, the daughter of Jacques Darc, peasant proprietor of Domremy, a small village partly in Champagne and partly in Lorraine. Joan received her sole religious instruction from her mother. In girlhood she was noted for her great physical energy, skill in all household work, exemplary conduct towards her parents and unselfish kindness to all. These qualities of mind and body were accompanied by intense mental activity and an abnormally sensitive nervous temperament. As she grew older she became inclined to silence, spending much time in solitude and prayer, and repelled all the advances of the young men of her acquaintance. At this time the English had extended their conquest over the whole of France north of the Loire, as well as Guienne, and while the infant Henry VI of England had, in 1422, been proclaimed King of France at his father's grave at St. Denis, Charles the Dauphin, given over to ease and luxury, was almost passively contemplating the slow dismemberment of his country by internal confusion and misery, and by the victories of the English. The fact that many of these misfortunes were owing to the conduct of his mother Isabella, who disinherited her son in favor of Henry V of England, the husband of her daughter Catherine, lent color to the ancient prophecy of the enchanter Merlin, that the calamities which should fall upon France through the depravity of a woman would be removed by the deeds of a virgin. In Joan's own country the tradition obtained that this virgin should come out of the forest of Domremy, where she tended her father's sheep. It is easily seen how, in such a time, this belief became the overpowering passion in a mind like hers, at once strongly sympathetic, ardently patriotic and full of a vivid imagination, until she was convinced of her high destiny, and, at last, all her waking hours were one prolonged prayer for her country's deliverance. Owing to a peculiarity in her nervous constitution, her own thoughts and hopes seemed to take audible voice and returned to her as assurances and commands spoken to her by the saints, which, when in 1428 Orleans, the key to southern France, was invested by the English, became so urgent as to overcome all pretexts for delay on account of previous discouragements and rebuffs. In spite of the remonstrances of her parents, therefore, she, after renewed efforts, succeeded in obtaining an introduction to Charles from Robert de Baudricourt, governor of Vaucouleurs, and in February, 1429, set out on her journey to the French court at Chinon, accompanied by two knights, her avowed mission being to relieve Orleans and crown the Dauphin at Rheims. At first, Charles would not see her, but popular feeling induced him to do so, and she finally persuaded him of the divinity of her commission, and was allowed to set forth with an army of 4,000 or 5,000 men for the relief of Orleans. At their head she rode, clad in a coat-of-mail, armed with an ancient sword which she had divined to be hidden near the altar of St. Catherine de Fierbois, and carrying a white standard of her own design embroidered with lilies, and having on one side an image of God seated on the clouds and holding the world in his hand, and on the other a representation of the annunciation. Joan was of medium height, stoutly built, but finely proportioned, and her frame was capable of enduring great fatigue. She does not seem to have been handsome in countenance, her face being, however, of pleasing aspect, with fine eyes, and she possessed a voice of great power and sweetness. Nominally she had been entrusted with the command of the army, but in reality it was under the direction of experienced generals: and it cannot be pretended that the victories won in consequence of her coöperation were the result of brilliant military genius. Indeed, she was blindly obstinate in refusing to acknowledge defeat in the face of overwhelming odds, and was actuated throughout by a fatalistic persuasion that victory was sure if she persisted. At the same time she had a shrewd and penetrating judgment of men and things, and in all her varied difficulties her manner showed extraordinary force of character, and a high and noble prudence. What, however, she chiefly supplied to the French cause was concentrated energy and resolution, and above all, she inspired the soldier with a fanatic enthusiam, and overawed the enemy through their fear of her alleged supernatural powers. She succeeded in entering Orleans on the 29th April, 1429, and at last forced the English to raise the siege ten days later. The capture of Jargeau and Beaugency was followed by the great victory of Patay, where Talbot was taken prisoner, and the English were driven beyond the Loire. The king then set out towards Rheims, which he entered with 12,000 men on July 16, Troyes having on the way been taken by assault. The next day, holding the sacred banner, Joan stood next to Charles at his coronation in the cathedral. The capture of Paris was then attempted, but on account of the disastrous result of an attack made on September 8, in which Joan was wounded, Charles, in spite of her passionate remonstrance, withdrew from the city and disbanded his troops. Joan went to Normandy to assist the Duke of Alençon, but returned to the court in December, when she and her family were ennobled with the surname of du Lis. In the next March she left the court to assist in the defence of Compiègne, against the Duke of Burgundy, who was in league with the English, and on May 24 led an unsuccessful sortie against the besiegers, when she was surrounded and taken prisoner. Charles made no effort to save her, and she was at last sold in November by Burgundy to the English, who, on January 3, 1431, at the instance of the University of Paris, delivered her over to the Inquisition for trial. After a public examination, begun January 9 and lasting six days, and another one conducted in the prison, she was on March 20, publicly accused as a heretic and sorcerer, and being found guilty, made her submission at the scaffold on the 24th of May, and received pardon. She was still, however, the prisoner of the English, and, having been induced by those who had charge of her to resume her male attire, she was on this account judged to have relapsed, was sentenced to death, and burned at the stake at Rouen, May 30, 1431. Her sentence was revoked by the pope in 1456.

DUBOIS. — Paul Dubois was born at Nogent-sur-Seine in 1829. In early life he began to fit himself for the profession of the law, but was constrained by his artistic tastes to devote himself to sculpture, and studied in Paris under Armand Toussaint, afterwards spending several years in Italy. His "Infant St. John," "Narcissus" and "A Florentine Singer of the Fifteenth Century," are in the Luxembourg. Dubois's most important work is the monument to General La Moricière in the Cathedral at Nantes. His other sculptures include "Eve"; a group of the "Virgin and Child"; an equestrian statue of the Constable Anne de Montmorency for the Château of Chantilly and a number of portrait busts, among

them being those of Baudry, Pasteur, Bonnat, Cabanel and Gounod. Dubois is also a painter in oil of much talent, and has produced some admirable copies of the old masters and many excellent portraits. He has won many medals and other honors.

Foyatier. — Denis Foyatier was born at Bussière in 1793, and studied under Lemot. He executed a number of monuments, among which may be mentioned statues of the Abbé Suger for Versailles; of Colonel Combes for Flers; of Major Martin for Lyons, and of Martignac for Miremont, together with various works for churches and other other public edifices, and a quantity of portrait busts. His ideal works include "Spartacus"; "Germanicus"; "The Shepherd Amaryllis"; "Love"; "The Athlete Asidamas saving a mother and child from destruction at Herculaneum"; "St. Cecilia" and "The Immaculate Conception." Foyatier died in Paris in 1863.

Le Veel. — Armand Le Véel was born at Bricquebec, and was a pupil of Rude. His works include an equestrian statuette of General Marceau and one of Francis I; an equestrian statue of Charlemagne; an equestrian statue of Napoleon I, at Cherbourg, and several portrait busts.

Princess Marie. — The Princess Marie d'Orléans, a daughter of Louis Phillippe, was born at Palermo in 1813. Having evinced a remarkable disposition towards the fine arts, she was given lessons in painting by Ary Scheffer and in sculpture by David d'Angers. In 1837 she married Duke Alexander of Würtemberg, but was taken ill the following year and died at Pisa in 1839. Her best-known work is a marble (pedestrian) statue of Joan of Arc now at Versailles (a bronze replica being in front of the Hôtel de Ville at Orleans); but she also executed a "Death of the Chevalier Bayard," and a marble figure of a praying angel, which is placed in the Chapel of St. Ferdinand in Paris, erected by Louis Phillippe in memory of her brother Ferdinand, Duke of Orleans. In the chapel at Fontainebleau is a stained-glass window made from her design, of St. Amalia, the patroness of her mother, Queen Amélie.

Passage. — Marie Gabriel Arthur, Vicomte du Passage, was born at Frohen and studied under Barye. He has exhibited various sculptures of animals at the *Salon*, including a group entitled "The Steeple-Chase: Jumping the Barrier"; a "Picardy Smuggler"; a "Hunting Mare and Groom"; a "Gaul carrying a wild-boar"; a "Gaul returning from the Chase," and "The Relay."

[To be continued.]

ILLUSTRATIONS

[Contributors are requested to send with their drawings full and adequate descriptions of the buildings, including a statement of cost.]

JOAN OF ARC, ORLEANS. D. FOYATIER, SCULPTOR. JOAN OF ARC, PARIS. E. FREMIET, SCULPTOR.

[Gelatine Print, issued only with the Imperial Edition.]

COURT-ROOM FURNITURE. MR. A. H. STEM, ARCHITECT, ST. PAUL, MINN.

COMPETITIVE DESIGNS FOR MEDALS TO BE AWARDED AT THE CINCINNATI ARCHITECTURAL EXHIBITION.

HOUSE FOR MRS. R. H. RICHARDS, ATLANTA, GA. MR. G. L. NORRMAN, ARCHITECT, ATLANTA, GA.

BUSINESS AND OFFICE BUILDING FOR FRANK RAUB, ESQ., NEW YORK, N. Y. MESSRS. DE LEMOS & CORDES, ARCHITECTS, NEW YORK, N. Y.

SAFE BUILDING.[1] — XXXVI.

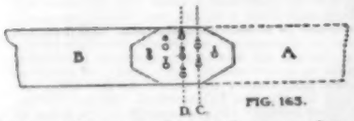


FIG. 165.

WHERE plates are lapped or joined by cover-plates, the rivets have to transfer the full strain from one plate to the other (in case of a lap); or from one plate to the cover-plate and from that to the other plate (in case of cover-plates). Of course, it can be readily seen that this means a large number of rivet-holes and a very great weakening of the plates. If it were practical to suddenly enlarge the plate at the riveting point there would be no loss, but this would be clumsy and besides it would not be practicable to roll plates with certain points enlarged or thickened. As the whole plate, however, will be equal only to its strength at its least cross-section the rivets should be so disposed as to weaken the plate as little as possible. This is done by pointing the plate ends in the case of lapping, or the ends of cover-plates where these are used, and are not covered in the construction. Where the plates are to be ultimately hidden out of sight, this expense is saved, the plate ends are left square, but the rivets are placed pointedly or pyramidically.

Plates weakened by holes.

Thus, in Figure 165 is shown a lapped joint with staggered rivets; we will suppose that calculation has shown the necessity of nine rivets to equal the tensional strain on each plate. The under plate A is dotted, the upper plate B drawn with full lines. By arranging the rivets as shown in Figure 165, each plate is weakened only by one rivet-hole. (As already explained the plates themselves need not necessarily be pointed, but can be left square, if expense must be considered and looks are no object.) For, while a section at C shows plate A weakened by two rivet-holes (Nos. 2 and 3) it must be remembered that the strain on A is no longer the full strain, but has been diminished by an amount equal to the work that would have come on the one rivet-hole; for rivet No. 1 has already transferred this amount to plate B. Similarly while a cut at D shows three rivet-holes (Nos. 4, 5 and 6) the plate is really not weakened at all here, for an amount of strain equal to what would have come on the metal taken from these rivet-holes has already been transferred to plate B by rivets Nos. 1, 2 and 3.

Lapped joints.

Similarly as the strain on B increases the rivet-holes in it diminish till at No. 9, plate B has got the full strain and is therefore only weakened by this one rivet-hole.

Butt joint with cover-plates.

The disadvantage of lapping plate ends is obvious, as the plate would not continue in the same plane. For this reason joints are generally made by butting the ends of the plates and covering one or both sides with cover-plates. The principle of riveting is the same as for lapped joints, but it will require a different disposition of the rivets, and twice the number of rivets, as plate A (Figure 166) has to transfer its strain to the cover-plate by one series of nine rivets, and the cover-plate transfers it to plate B by another series of nine rivets. This can be readily seen in Figure 166. In this case the disposition of the rivets requires an extra rivet each side, or 20 in all.

Two cover-plates best.

Where it is not necessary to keep plates A and B in the same plane it would be cheaper and better of course to lap them, rather than to use *one* cover-plate. If, however, two cover-plates can be used, one on top of the plates and the other under them, the advantage is very great, as the strain will be transmitted in a direct line or plane from plate A to plate B, and besides this the joint is greatly strengthened by the friction between the cover-plates and plates A and B. In an experiment made by Clark with three $\frac{3}{4}$ inch thick plates riveted with one $\frac{7}{8}$ inch rivet through an oblong hole, it was found that friction added about 5 tons resistance against pulling out the centre plate. This would seem to add a safe-strength to each $\frac{7}{8}$ inch rivet of $\frac{5}{f}$ and if $f = 5$ (or a factor-of-safety of 5 were used) it would add just one ton to the calculated strength of a $\frac{7}{8}$ inch rivet. This increase, however, is a doubtful one, and would probably be lost in time by a gradual wearing of the plates due to this very friction, or possibly from slight rusting or other causes; no allowance should therefore be made for extra strength due to friction, but it certainly is a great advantage in making joints; and the above facts may account largely for the discrepancies in experiments on riveted joints, where no allowance is made for friction.

Gain by Friction.

The pitch of rivets is, of course, governed by circumstances. The rule is to try to arrange the rivets, so that the strength of the plate between them shall equal the actual strength of the rivet.

Boiler Riveting.

In boiler-work, however, they must be located not only for strength, but must be placed close enough to make the joint steam-tight. For this reason, too, boiler-plates are always lapped, the joint being more easily caulked and made tight.

In constructional work, however, there will be a great loss and waste of material, if the rivets are placed too closely. In plate girders and riveted joints in trusses the rule is not to make the pitch

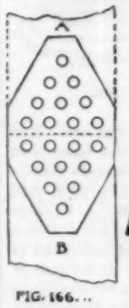


FIG. 166.

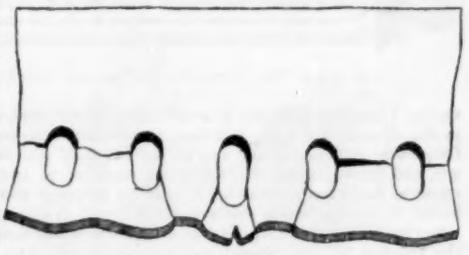


FIG. 167.

less than $2\frac{1}{2}$ diameters for punched-work, nor more than sixteen times the thickness of the least plate at the joint, or:

$$p = 16.t \qquad (107)$$

Greatest Pitch.

Where p = the greatest pitch, in inches, for rivets of plate-girders or riveted trusses.

Where t = the thickness of the thinnest plate, in inches.

The pitch is measured from centre of hole to centre of hole on a direct (straight) line.

$$p_1 = 2\tfrac{1}{2}.d \qquad (108)$$

Least Pitch.

Where p_1 = the least pitch, in inches, for rivets of plate-girders or riveted trusses.

Where d = the diameter of rivet-holes, in inches.

The exact pitch must be between these two limits; and is, of course, calculated.

Diameter of rivets.

Different writers have attempted to lay down exact rules for the size of rivets to be used, using for a basis for the formulæ the thickness of thinnest plate to be riveted. Such rules, however, generally do not agree with good practice, as they either make the rivets too small for thin plates, or too large for thick ones, or *vice versa*.

[1] Continued from No. 721, page 180.

As a rule the local circumstances must control the selection of the size of rivet; the following, however, may serve as a general guide:
For plates from $\frac{1}{4}''$ to $\frac{7}{16}''$ thick, use rivet-holes $\frac{5}{8}''$ diameter.
For plates from $\frac{1}{2}''$ to $\frac{9}{16}''$ thick, use rivet-holes $\frac{3}{4}''$ diameter.
For plates from $\frac{5}{8}''$ to $\frac{15}{16}''$ thick, use rivet-holes $\frac{7}{8}''$ diameter.
For plates from $\frac{7}{8}''$ to $1''$ thick, use rivet-holes $1''$ diameter.

Of course, larger or smaller rivets can be used, but as a rule $\frac{5}{8}$ inch, $\frac{3}{4}$ inch, and $\frac{7}{8}$ inch are most desirable.

Figure 167 shows the different ways in which riveted-work will yield. This figure is made from a photograph of an actual specimen, tested and torn apart at the Watertown arsenal.

It is evident that the plate began yielding by all of the rivets compressing or crushing the plates, and finally yielded completely by tearing apart from 2 to 1 and to left edge and the same from 4 to 5 and the right edge, while rivet 3 tore its way completely out, shearing off a piece of the plate, and rivets 2 and 4 partially so.

How plate yields.

The iron plates tested were 15 inches wide, $\frac{1}{2}$ inch thick, with two iron cover-plates 15 inches x $\frac{9}{16}$ inch each. The rivets were $\frac{15}{16}$ inch of iron and filled 1 inch drilled holes, pitch 3 inches.

The gross area of plate was 3,765 square inches, the net area 2,510. The total bearing-surfaces of rivets on the plates aggregated 1,255 square inches, and their aggregate shearing areas, (being in double shear) was 7,854 square inches. At 116715 pounds strain the edges contracted and scale on the specimen began to start and the plate yielded as shown at 167200 pounds strain. This was equal to 44410 pounds tension per square inch on the uncut plate, or 66610 pounds per square inch on a line at the rivet-holes (or net area).

The compression from the rivets was 133230 pounds per square inch, while the shearing was only 21290 pounds per square inch.

This example shows clearly how the plate yields. Besides this the joint might yield by breaking or shearing off the rivets. We have then the following six manners in which a riveted-joint might yield.

How Riveted Joint yields.

1. By crushing either the rivet or the rivet crushing the plate.
2. By shearing off the rivet — in single shear.
3. By shearing off the rivet — in double shear.
4. By bending or cross-breaking of the rivet.
5. By tearing the plate apart or crushing it between rivet-holes.
6. By the rivets shearing out the part of the plate between them and the edge.

In Figures 168, 169 and 170 are shown three kinds of joints, each with a single rivet transferring the whole strain; in Figure 168 directly from plate *A* to plate *B*; in Figure 169 transferring strain from plate *A* to cover-plate and thence to plate *B*; and in Figure 170 transferring one-half of the strain *A* to *each* cover-plate and thence each half is transferred back again to plate *B*.

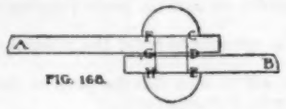


FIG. 168.

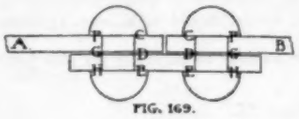


FIG. 169.

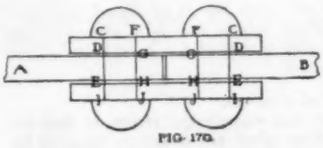


FIG. 170.

It should be remarked here that cover-plates (as in Figure 169) should be at least the full width and thickness of the original plates. In practice they are made a trifle thicker (about $\frac{1}{16}$ inch or more).

Cover-plates, as in Figure 170, should *each* be the full width of original plates and at least one-half the thickness of same; in practice they too are each made about $\frac{1}{16}$ inch (or more) thicker.

The plates *A* and *B* are themselves, of course, of the same thickness.

Now to prevent failure by the first method, compression, there must be area enough at both *G H* and *C D*, not to crush the rivet or the plates at these points, (*C D* + *E I* and at *G H* in Figure 170). This area is considered equal to the thickness of either plate *A* or *B* (or of cover-plate or their sums) multiplied by the diameter of rivet-hole.

Failure by Compression.

To resist failure by the second method, single-shearing of rivet, the area of cross-section of each rivet must be sufficient not to shear off under the total strain on either plate *A* or *B*. It will be readily seen that only the rivets in Figures 168 and 169 are subjected to single shearing, *viz:* at their sections *G D*. The rivets in Figure 170 have two areas resisting shearing, *G D* and *H E*, hence are subjected to double shearing; therefore their area of cross-section need only be sufficient to resist a shearing strain equal to only one-half of the *total* strain on either plate *A* or *B*, in order to avoid failure by the third method.

Failure by Shearing.

To avoid failure by the fourth method, the rivet must be sufficiently strong to resist the load as a lever in Figures 168 and 169, and as a beam in Figure 170.

Failure by bending.

In Figures 168 and 169 we can consider the part *D C F G* as the built-in part of a lever, with a free end *D E H G* which carries a uniform load equal to the whole strain on either plate *A* or *B*.

In Figure 170 we have a beam supported at *C D G F* and *E I J H*, with its span or central part *G H E D* loaded with a uniform load equal to the whole strain on either plate *A* or *B*.

To prevent failure by the fifth method the area of cross-section of either plate taken at right angles across same through the rivet-hole — (that is, deducting the rivet-hole from the area of cross-section) — should be sufficient to resist the tension or compression.

Failure of plate.

To prevent failure by the sixth method the rivets must be far enough from the edges of plates (cover and original plates) not to shear out the metal ahead of them. The rule is shown in Figure 171. Make angle *A O C* = 90° that is a right angle (*O* being the centre of rivet-hole and *C A* part of its circumference), and so that the directions of *O A* and *O C* are at 45° with edge of plate *D B*. Then the sums of the areas *A B* + *C D* — (that is, *A B* + *C D* multiplied by thickness of plate) — must be sufficient to resist the longitudinal shearing strain, which in this case would be the strain on either plate *A* or *B* (Figures 168 to 170).

Failure by rivets tearing out.

To put the above in formulæ we should have:

Bearing.
$$x = \frac{s}{d.\,h.\left(\frac{c}{f}\right)} \qquad (109)$$

Use x for lap joints only.

Use $2\,x$ in place of x for butt joints with single or double cover-plates.

Single Shearing.
$$x = \frac{s}{0{,}7857.\,d^2.\left(\frac{g}{f}\right)} \qquad (110)$$

Use x for lap joints only.

Use $2\,x$ in place of x for butt joints with single cover-plate.

Double Shearing.
$$x = \frac{s}{1{,}5714.\,d^2.\left(\frac{g}{f}\right)} \qquad (111)$$

Use $2\,x$ for butt joints with double cover-plates.

Bending-moment Lever.
$$x = \frac{s.\,h.}{0{,}1964.\,d^3.\left(\frac{k}{f}\right)} \qquad (112)$$

Use x for lap joints only.

Use $2\,x$ for butt joints with single cover-plates.

Bending-moment Beam.
$$x = \frac{s.\,h}{0{,}7857.\,d^3.\left(\frac{k}{f}\right)} \qquad (113)^1$$

Use $2\,x$ for butt joints with double cover-plates.

Tension on Plate.
$$h = \frac{s}{b.\left(\frac{t}{f}\right)} \qquad (114)$$

Use $\left(\frac{c}{f}\right)$ instead of $\left(\frac{t}{f}\right)$ if plate is in compression.

Shearing end of plate.
$$y = \frac{s}{2.\,h.\left(\frac{g}{f}\right)} \qquad (115)$$

(If more than one rivet use $\frac{s}{x}$ instead of s for distance of each rivet from end as shown in Figure 171.)

Where s = the whole load or strain, in pounds, to be transferred from one side of the joint to the other.

Where d = the diameter of rivet-hole, in inches.

Where h = the thickness of plate, in inches. Where more than one plate is used, take for h the *least* aggregate sum of thickness of all plates acting in one direction. (The sum of cover-plates should at least equal this aggregate in thickness and should be larger, where the net b of cover-plates is smaller than the net b of connected plates.)

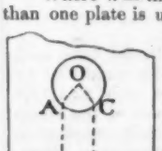


FIG. 171.

Where b = the net breadth of plate, in inches, that is the breadth, less rivet-holes, at the weakest section; where more than one plate is used they should all of course be of same breadth. The net b of cover-plates will frequently be much less than that of original plates, as they lose the greatest number of rivet-holes at their centre, where they are carrying the full strain.

Where x = the total number of rivets required at the joint for lap joints, and the number required *each side of joint* for butt joints with single or double cover-plates; that is in the latter two cases $2\,x$ will be the total number of rivets required.

Where y = in inches, is the length *A B* or *C D* (Figure 171) from *any* rivet to free edge of plate; where more than one rivet is used, insert $\frac{s}{x}$ in formula, in place of s. It will only be necessary, of course, to calculate y for the line of rivets nearest free edge.

Where $\left(\frac{c}{f}\right)$ = safe compression stress, per square inch,

Where $\left(\frac{t}{f}\right)$ = safe tension stress, per square inch,

[1] The fourth decimal given in formulæ is not quite right, but is made to correspond with fractions used in Table I.

Where $\left(\frac{g}{f}\right)$ = safe shearing stress, per square inch,

Where $\left(\frac{k}{f}\right)$ = safe modulus of rupture, per square inch,

all in pounds, (see Table IV).

Safe stresses on rivets and pins. The writer uses the following values, as a rule for *rivets and pins.*

For Wrought-iron.

$\left(\frac{c}{f}\right) = 12000$ pounds, per square inch.

$\left(\frac{t}{f}\right) = 12000$ pounds, per square inch.

$\left(\frac{g}{f}\right) = 8000$ pounds, per square inch.

$\left(\frac{k}{f}\right) = 15000$ pounds, per square inch.

For Steel.

$\left(\frac{c}{f}\right) = 15000$ pounds, per square inch.

$\left(\frac{t}{f}\right) = 15000$ pounds, per square inch.

$\left(\frac{g}{f}\right) = 10000$ pounds, per square inch.

$\left(\frac{k}{f}\right) = 18000$ pounds, per square inch.

Example I.

Lap Joint. *A wrought-iron plate, which cannot be over 12″ wide, is so long that it has to be made in two lengths; the joint is to be a lap joint. The plate is in tension and is strained 65000 pounds. Design the joint.*

We will assume that we propose to design the joint as shown in Figure 165, with staggered rivets, in that case the plate will only be weakened by one rivet-hole. We can readily see that the plate will not need to be very thick and decide to use $\frac{3}{4}$″ rivets, (that is $\frac{3}{4}$″ rivet-holes); we then shall have a net breadth of plate

Size of plate. $b = 12'' - \frac{3}{4}'' = 11\frac{1}{4}''$.

Of course $s = 65000$ in this case, and we know that

$$\left(\frac{t}{f}\right) = 12000;$$

inserting these values in Formula (114) we have:

$$h = \frac{65000}{11\frac{1}{4}.\ 12000} = 0{,}485''$$

Or we should use a plate one-half inch thick.

We next determine the number of rivets required.

In the first place there must be enough for bearing, that is not to crush the plate or get crushed by it. We use

Required number of rivets. Formula (109) inserting the values, and have:

$$x = \frac{65000}{\frac{3}{4}.\frac{1}{2}.\ 12000} = 14{,}44$$

Or we should need 15 rivets for bearing. Had we figured without using the formula, we should have said, the bearing area of each rivet is $\frac{3}{4}'' = \frac{1}{2}'' = \frac{3}{8}$ square inches, this at 12000 pounds, per square inch, would equal 4500 pounds safe-compression for each rivet, dividing this into 65000 pounds, the strain, would, of course, give the same result 14,44 or say 15 rivets.

We next see if there is any danger from shearing. The joint being a lap joint, the rivets will have, of course, only one sectional area to resist shearing, that is, will be in single shear, so that we use Formula (110) and inserting values have:

$$x = \frac{65000}{0{,}7857.\ (\frac{3}{4})^2.\left(\frac{g}{f}\right)} = 18{,}39$$

Or we must use 19 rivets to prevent the shearing.

Had we figured without the use of formula, we should have said, area of a $\frac{3}{4}''$ rivet is $= 0{,}4417$ square inches. This multiplied by 8000 pounds (the safe shearing stress per square inch) $= 3533{,}6$ pounds, or each rivet could safely assume this amount of the strain without shearing. This amount being *less* than the safe compression on each rivet, would, of course, require a larger number of rivets, and should therefore be used, rather than the latter. We have, in effect $\frac{65000}{3533{,}6} = 18{,}39$ or say 19 rivets, being four more than required for bearing.

We next take up the question of bending; the joint being lapped the rivets will practically become short levers. We use Formula (112); inserting values, we have:

$$x = \frac{65000.\frac{1}{2}}{0{,}1964.\ (\frac{3}{4})^3.\ 15000} = 26{,}15$$

Or we should have to use at least 26 rivets to prevent bending; which readily illustrates the great disadvantage of not transferring the strain in a direct plane, by using two cover-plates.

Had we not used the formula, we should have said, we have here a $\frac{3}{4}''$ circular lever, the free end projecting $\frac{1}{2}''$ and loaded uniformly with a load of 65000 pounds.

From Formula (25) or Table VII we have the bending-moment

$$m = \frac{65000.\frac{1}{2}}{2} = 16250 \text{ pounds-inch.}$$

and from Table I, section No 7 the moment of resistance,

$$r = \frac{1}{11}.\ (\frac{3}{4})^3 = 0{,}04143$$

From the formula on page 49, Volume I,

$$\frac{m}{r} = s$$

we have the total extreme fibre strains on all the rivets,

$$s = \frac{16250}{0{,}04143} = 392228 \text{ pounds.}$$

This divided by the safe strain, or safe modulus of rupture $\left(\frac{k}{f}\right) = 15000$ pounds, will give the number of rivets required, *viz:*

$$\frac{392228}{15000} = 26{,}15$$

or 26 rivets as before.

We still have to decide the distance y (or $A\ B$, Figure 171). We use Formula (115). As there are more than one rivet we use in place of s the strain on each rivet or $\frac{s}{26}$, which was the largest number required as above, therefore:

$$\frac{s}{26} = \frac{65000}{26} = 2500$$

Inserting this in Formula (115) we have:

$$y = \frac{2500}{2.\ \frac{1}{2}.\ 8000} = 0{,}3125''$$

This, however, being less than our rule which requires $1\frac{1}{2}$ diameters from centre of hole to edge, we will stick to the rule.

We now design the joint.

We have a plate 12″ wide, $\frac{1}{2}$″ thick, lapping, and require 26 rivets.

Designing the joint. They must be arranged not to weaken the plate by more than one rivet-hole.

If we arrange the rivet-holes as shown in Figure 172, we will find it the most economical arrangement. To be sure it allows for only 25 rivets, but that will probably be near enough, otherwise we should have to insert at least five more to keep them symmetrical. It will be readily seen that the weakest point is at section A where one rivet-hole is lost.

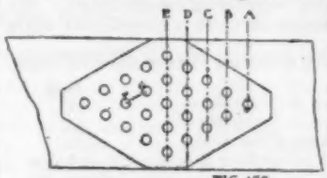


FIG. 172.

Section B is of same strength, two rivet-holes being lost, but the strain has been reduced by an amount equal to the value of one rivet-hole.

At section C we lose three rivet-holes, but the strain has been reduced by the value of three rivet-holes, so that the plate practically has its full value here.

At sections D and E the plate is stronger to resist the remaining tension than required.

By figuring out E (12″ wide) it will be seen that the pitch on this line is more than required by the rule, Formula (108).

The pitch $F\ G$ between two adjacent lines of rivets, measured on the slant from centre to centre of rivets, should be at least $2\frac{1}{2}$ diameters, $2\frac{1}{2}.\ \frac{3}{4} = 1\frac{7}{8}''$ or say 2″.

It will be good practice for the student to carefully lay this joint out to scale.

Example II.

Butt joint single cover-plate. *A steel plate 10″ wide has to be pieced, and for local reasons this can only be done by a cover-plate on one side. The plate is subjected to a tensional strain of 135000 pounds. Design the joint.*

Of course, the rivets must be of steel too.

We will again assume that we can stagger the rivets, so that we shall lose only one rivet-hole. The plate will evidently have to be thick and we will decide to use 1″ rivets; this would leave us a net breadth of plate

Size of plate. $b = 10'' - 1'' = 9''$

From Formula (114) we have:

$$h = \frac{135000}{9.\ 15000} = 1''$$

Or the plate will have to be just one inch thick. The cover-plate should be at least the same, if there were only one rivet, but as there will evidently be more than one and we propose staggering the rivets, the cover-plate will have to be considerably thicker; we can therefore leave the cover-plate out of consideration for the present as, being thicker, or in case of one rivet equal to the plates to be joined, it will certainly be as strong, and not crush.

Required number of rivets. Now, as for the number of rivets, from Formula (109) we have for bearing:

$$x = \frac{135000}{1.\ 1.\ 15000} = 9$$

Or nine rivets are required not to crush the plate or be crushed by it (each side of joint).

From Formula (110) we have for single shearing (as there is evidently only one area to each rivet to resist shearing):

$$x = \frac{135000}{0{,}7857.\ 1^2.\ 10000} = 17{,}2$$

Or seventeen rivets are required to resist the shearing (each side of joint). The rivets will evidently be levers in this case and we have from Formula (112)

$$x = \frac{135000 \cdot 1}{0{,}1964 \cdot 1^3 \cdot 18000} = 38{,}1$$

Or it will require thirty-eight rivets to resist the bending-moment (each side of joint). This again shows the advantage of using both a top and bottom cover-plate and so avoiding the great leverage on the rivets.

Designing the joint.

It must now be borne in mind that the joint is a butt joint, therefore, unlike the case of lap joint where the whole number of rivets bear on each plate, we must here use twice the number, as only one-half, or those each side of the joint bear on one plate, or we require in all 76 rivets.

The plate is so narrow that we cannot get more than three rivets on a line across the plate, without infringing on the rules for pitch. We can, therefore, stagger the end rivets and make the rest either

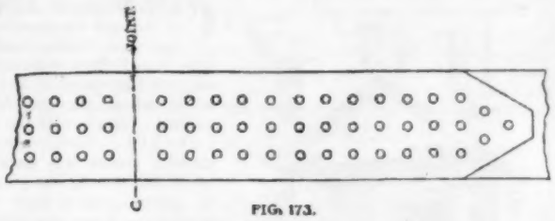


FIG. 173.

chain riveted or zig-zag riveted. The chain riveting will require a little longer cover-plate, but in the case of a plate-girder flange would have the advantage of using the rivets that are needed for the angle-irons.

In that case we should not stagger the end rivets, for our plate would only be weakened by one additional hole, and, of course, the gross breadth of plate would have to be 12 inches instead of 10 inches to give same strength.

Figure 173 shows this joint chain riveted, with end rivets, staggered, to correspond to our calculated example.

We see that it takes 39 rivets each side of joint for symmetry.

Figure 174 shows this joint zig-zag riveted. It has three advantages over the other, it is shorter, takes just the right number of

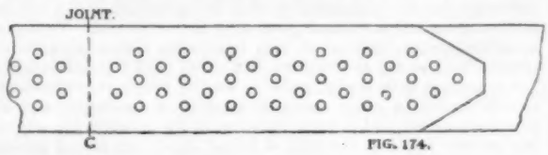


FIG. 174.

rivets and requires a thinner cover-plate. For in Figure 173 at the first line of rivets (C) next to the joint, the cover-plate loses three rivet-holes and bears the full strain, or its clear breadth would be only 7 inches and from Formula (114) would require a cover-plate of thickness

$$h = \frac{135000}{7.15000} = 1{,}3$$

or say $1\frac{3}{16}$″ thick.

Whereas, in Figure 174, at the line C we lose only two rivets and have consequently a clear breadth of 8 inches and require from Formula (114) a cover-plate of thickness equal to

$$h = \frac{135000}{8.15000} = 1{,}125$$

or only $1\frac{1}{8}$ inch cover-plate.

Had we not used the formula we should have figured out our rivets, etc, as follows:

Required net or clear area of plate

$\frac{135000}{15000} = 9$ square inches. Net breadth being 9″ gives, of course, 1″ thickness.

Bearing area of each rivet $= 1.1 = 1$ square inch, which will safely bear 15000 pounds or we should need

$\frac{135000}{15000} = 9$ rivets.

Single shearing area of each rivet (or area of a circle 1″ diameter) $= 0{,}7854$ square inches, which at 10000 pounds per square inch, would give a resistance to shearing per rivet $= 7854$ pounds or we should need

$\frac{135000}{7854} = 17{,}2$ rivets. For bending we should have a one inch circular lever, projecting one inch and uniformly loaded with 135000 pounds.

The bending-moment would be Formula (25)

$$m = \frac{135000.1}{2} = 67500 \text{ pounds.}$$

The moment or resistance would be Table I, section No. 7

$$r = \tfrac{1}{1}\cdot\left(\tfrac{1}{2}\right)^3 = 0{,}0982$$

The strain s, therefore, on all the rivets will be [page 49, Volume I]

$$s = \frac{67500}{0{,}0982} = 687373$$

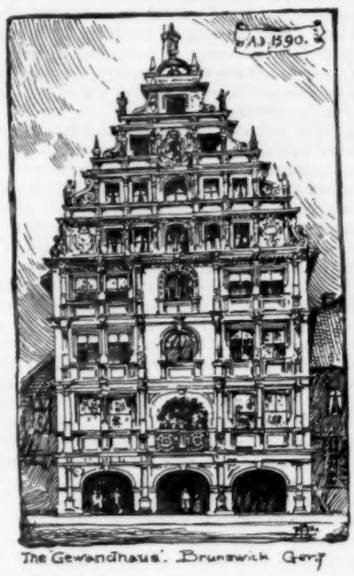
This divided by the safe modulus of rupture for steel rivets $\left(\frac{k}{f}\right) = 18000$ will give the required number, as before,

$\frac{687373}{18000} = 38{,}2$

Louis DeCoppet Berg.

[To be continued.]

THE CHANNEL BRIDGE.



THE author of a paper, which was read at the recent meeting of the Iron and Steel Institute, is M. Henri Schneider. Its title is "The Channel Bridge, Preliminary Designs by Messrs. Schneider and Co. (Creusôt Iron Works), and H. Hersent," whilst at the bottom of the title-page it is added that Sir John Fowler and Mr. Benjamin Baker, chief engineers to the Forth Bridge, are consulting engineers. When we add that the President, Sir James Kitson, stated, during the discussion, that an eminent firm of financiers — who could, as he said, finance any scheme they had a mind to — had undertaken to find the money, it would seem as if the Channel Bridge — as a project at any rate — had come amongst us, and come to stay. We shall content ourselves with a brief abstract giving the chief elements of design in this Cyclopean dream of giant minds.

The amount of metal and machinery to be provided for the construction of a bridge over the Channel would represent an aggregate weight of about 1,000,000 tons; and it is assumed that each country, England and France, would supply about one-half of the quantity — a statement at once calculated to enlist the sympathies of a meeting of the Iron and Steel Institute. To pay for masonry supports the sum of 380,000,000 francs would be required, whilst the metallic superstructure would absorb 480,000,000 francs. The total would be 860,000,000 francs, or, say 34,000,000 pounds sterling.

For site the shallow part of the Channel stretching between Folkestone and Cape Grisnez has been selected. Here the shoals of the Colbart and Varne help the engineer. The deepest water in which foundations would have to be sunk would be 55 metres, or, say 30 fathoms. The total length bridged would be 38,600 metres, or $24\frac{1}{2}$ miles.

The result of experiment shows that the bottom is not unfavorable, the ground being sufficiently solid to support very extensive works. The white and blue chalk, which everywhere forms the Channel bottom, will carry 10 to $12\frac{1}{2}$ kilogrammes per square centimetre, or, say 10 tons per square foot. Soft parts of the surface and sediment will have to be removed at certain points. Each supporting pier will be a solid masonry rectangle 25 metres (82 feet) in length and of width to suit the columns. It will be brought above high-water level. Above will rise metal columns. The surface in contact with the ground may be 1604 square metres (17,265 square feet) or less according to depth. The masonry will be built inside metal caissons forced by compressed air down to the solid ground. The caissons will be surmounted by metal cases surrounding the masonry and will serve to float the piers until they touch the ground. The distance between the piers is fixed at 500 and 300 metres (984 feet and 1640 feet) for the large spans and will not be less than 200 and 100 metres (656 feet and 328 feet) respectively for the small spans. This, it is said, will prevent them proving an obstacle to free navigation of even sailing vessels.

The metallic columns are to be, as is all the metal-work, of steel, the height varying between 40 and 42.78 metres (131 feet and 140 feet). On these will be placed the main girders of the bridge. The head-room, or rather mast-room, will be at high-water springs 54 metres, or 177 feet. From the form of construction this height will continue throughout the spans. This height, we may state, is about 26 feet more than that of the Forth Bridge. Simple, unlatticed, trussed girders have been adopted in the design. The permanent way is 72 metres (236 feet) above the low-water level. There will be double sets of rails and the width of the flooring proper will be 8 metres (26 feet 3 inches). The whole width of the bridge is variable, the greatest distance between the main girders is 25 metres (82 feet 3 inches), such a space being necessary the insure the stability of the structure against violent wind.

The most difficult operation is estimated to be the placing of piers, and the special precautions to be observed are detailed in the paper. The method to be adopted of floating out the piers is very ingenious, and there appears to be no doubt in the minds of those concerned that they will be successful, although the undertaking is of so bold and novel a character. It is pointed out that at Toulon masses of brickwork representing a weight of 100,000 tons have been kept afloat in the caissons for several months.

A port will be constructed on either coast, especially arranged to facilitate the work. If a pier, when taken to its site and sunk, were found to be not in its proper position, it would be necessary to float it again by compressed air. The position of a column in the centre of anchored barges attached by moorings is compared to that of a spider in the middle of its web. Oil is to be employed to smooth the water if necessary. It is proposed to complete the whole work within a period of ten years from starting.

In considering the spans of 300 and 500 metres, the first idea is to form the spans of girders extending over the whole length of 300 metres and extending on either side in the form of cantilevers of 250 metres, so that the junction of the two cantilevers should constitute a span of 500 metres in all. It is found, however, that the addition of a central independent span is advisible; a saving of about 17 per cent of weight is thus realized in each overhanging portion of the cantilever. The flooring of the bridge is formed of two girders resting on two piers. Each girder consists of two members, or chords, connected by bracings forming isosceles triangles. The lower flanges of the two girders have a distance of 25 metres between their axes in the central span of 300 metres and an interval of 10 metres at the ends. They are horizontal in the central span, but are raised to a height of 5 metres at the ends of the cantilevers. For erecting the cantilever arms auxiliary and removable piers are to be used; for the larger spans two of these auxiliary piers will be required. Very elaborate details of weights, calculations of resistance, stability of piers, etc., are given, but for these we must refer our readers to the paper itself.

Before the discussion was commenced the President requested speakers to confine themselves to those constructive details on engineering questions which might fairly come within the scope of the meeting of the Iron and Steel Institute, and not wander off into political questions and those relating to navigation, a request which was not much regarded by some of those who took part in the discussion.

The first speaker was Mr. Daniel Adamson, who said he would have been glad to confine himself to the lines laid down by the President, but it was impossible to forget that there was a national and commercial side to the proposals put forward, as well as an engineering aspect. He questioned whether the French people were not being asked to give twenty-five shillings for a British sovereign. It was impossible to consider this scheme without looking to the alternative proposals of a tunnel, neither could it be ignored that all nations have a right to the free navigation of the Channel between England and France. A feature that would modify the commercial or financial aspect of the scheme would be the advance that might fairly expected to be made in steamship economy during the ten years of the bridge's construction. During the last ten years fuel consumption in steamers had been reduced in a very considerable manner, and if the next ten years showed a like progress, sea carriage would be still further cheapened. Even now an ocean steamer would carry cargo at one-fifth of a penny per ton per mile as compared to the 1*d.* to 2½*d.* of railway carriage. It may, however, be pointed out here, as the supporters of the scheme would doubtless have done had they been present, that in across-Channel freightage it is not the actual carriage per ton-mile, but the transhipment of goods. To make the comparison just, Mr. Adamson should have taken the cost of unloading goods from railway trucks to steamer on one side, and from steamer to train again on the other, and have added this to the ton-mile of carriage for the 20 or 30 miles of Channel passage.

Comparing the designs before the meeting with those of the Forth Bridge, Mr. Adamson rejoiced that there was not a prospect of the latter being adopted. He also referred to the great cost of painting the bridge. He said it would be liable to total disablement from one piece being knocked out by collision from a passing steamer, apparently being much in the same frame of mind as the member of Parliament who asked George Stephenson the immortal question about the cow. In conclusion he thought the scheme wanted serious consideration, but he rejoiced that something should be done tending to free commercial intercourse, make nations more neighborly, and make the world wiser and better.

Mr. Tilden Wright said he appeared as an advocate of the Channel Tunnel. For the last six or seven years he, with others, had worked for the Channel Tunnel, and he was glad some other party had come at last to help them in their struggle against prejudice. But though he was in favor of connecting England and France by some physical tie, he considered that the bottom of the sea was a more suitable medium than an aërial connection, and the estimated cost of the tunnel was but one-sixth the estimated cost of the bridge.

In summing up the discussion, the President said — in reference to some remarks which fell from Mr. Adamson respecting the scheme being the outcome of "youthful and enthusiastic minds with courage only equalled by their audacity" — that the names which backed the scheme had been apparently overlooked by Mr. Adamson. He thought Sir John Fowler, at any rate, might be supposed to have sown his professional wild oats. He had just finished the Forth Bridge, and had told him (Sir James) personally that he would guarantee the Channel Bridge. If so great an engineer as Sir John said such a thing as this, there only remained one formality, to find the money. A great financier in Paris — one who could do almost anything in the way of money — had told him (Sir James) that he would find the money — a fact which he, as a maker of iron and steel, was delighted to hear, as he hoped that he, in common with many other members of the Institution, would find a good deal of his material incorporated in the Channel Bridge. — *Engineering.*

PHOTOGRAPHING COLORS.

Capt. W. de W. Abney, in a paper on the effect of light on matter read before the British Association, said: "The question is often asked when photography in natural colors will be discovered. Photography in natural colors not only has been discovered, but pictures in natural colors have been produced. I am not alluding to the pictures produced by manual work, and which have from time to time been foisted on a credulous public as being produced by the action of light itself, much to the damage of photography and usually to the so-called inventors. Roughly speaking, the method of producing the spectrum in its natural colors is to chlorinize a silver plate, expose it to white light till it assumes a violet color, heat till it becomes rather ruddy, and expose it to a bright spectrum. The spectrum colors are then impressed in their natural tints. Experiment has shown that these colors are due to an oxidized product being formed at the red end of the spectrum and a reduced product at the violet end. Photography in natural colors, however, is only interesting from a scientific point-of-view, and, so far as I can see, can never have a commercial value.

"A process to be useful, must be one by which reproductions are strictly made; in other words, it must be a developing and not a printing process, and it must be taken in the camera, for any printing process requires not only a bright light, but also a prolonged exposure. Now, it can be conceived that in a substance which absorbs all the visible spectrum, the molecules can be so shaken and sifted by the different rays that eventually they sort themselves into masses which reflect the particular rays by which they are shaken; but it is almost — I might say quite — impossible to believe that when this sifting has only been commenced, as it would be in the short exposure to which a camera picture is submitted, the substance deposited to build up the image by purely chemical means would be so obliging as to deposit in that the particular size of particle which should give to the image the color of the nucleus on which it was depositing. I am aware that in the early days of photography we heard a good deal about curious results that had been obtained in negatives, where red-brick houses were shown as red and the blue sky as bluish. The cause of these few coincidences is not hard to explain, and would be exactly the same as when the red-brick houses were shown as bluish and the sky as red in a negative. The records of the production of the latter negatives are naturally not abundant, since they would not attract much attention. I may repeat then that photography in natural colors by a printing-out process — by which I mean by the action of light alone — is not only possible, but has been done, but that the production of a negative in natural colors from which prints in natural colors might be produced appears, in the present state of our knowledge, to be impossible. Supposing it were not impracticable, it would be unsatisfactory, as the light with which the picture was impressed would be very different from that in which it would be viewed.

"Artists are fully aware of this difficulty in painting, and take their precautions against it. The nearest approach to success in producing colored pictures by light alone is the method of taking three negatives of the same subject through different colored glasses, complementary to the three color sensations which together give to the eye the sensations of white light. The method is open to objection on account of the impure color of the glasses used. If a device could be adopted whereby only those three parts of the spectrum could be severally used which form the color sensations, the method would be more perfect than it is at present. Even then perfection could not be attained, owing to a defect which is inherent in photography and which cannot be eliminated. This defect is the imperfect representation of gradation of tone. For instance, if we have a strip graduated from what we call black to white (it must be recollected that no tone can scientifically be called black and none white) and photograph it, we shall find that in a print from the negative the darkness which is supposed to represent a gray of equal mixtures

of black and white, by no means does so, unless the black is not as black or the white as white as the original."

SOCIETIES

ST. LOUIS ARCHITECTURAL LEAGUE.

THE bi-monthly meeting of the League was held at their rooms, Saturday evening, October 12, with a good attendance. Designs were submitted for a City Front; the judges to report at the next regular meeting. Action was taken in regard to the annual meeting in November. It was decided to give an informal reception to a limited number of guests, the programme being as follows:

Business meeting, at 6 o'clock P. M.; Reception, at 8 o'clock P. M. There will be an address by the President; the announcement of the prizes of the annual competition; a lunch, and an exhibit of drawings, the work of the present year. After a general discussion of proposed work for the coming year the Club adjourned to meet October 26.

BOSTON ARCHITECTURAL CLUB.

THE Club is to give a reception, Thursday, October 24, to Mr. Edgar Josselyn, the fourth Rotch Travelling Scholar. Mr. Josselyn's scholarship work and sketches will be on public exhibition during the week at the Club rooms, No. 6 Hamilton Place.

The membership lists of the club are now nearly complete, there being only twelve vacancies. Any who are thinking of becoming members are requested to send their names at once to the Secretary.

COMMUNICATIONS

[*The editors cannot pay attention to demands of correspondents who forget to give their names and addresses as guaranty of good faith; nor do they hold themselves responsible for opinions expressed by their correspondents.*]

THE STRICTURES OF THE DAILY PRESS.

ROCHESTER, N. Y., October 14, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — I enclose you a clipping from the editorial page of one of our leading newspapers, which gives a good idea of how public opinion is influenced against our profession by the press, which, in all other arts and sciences, generally sides with the right.

I presume the paragraph was inspired by the recent meeting of architects at Syracuse, in which convention the most important matter brought up for discussion was the proposed law placing restrictions upon the practice of architecture similar to those upon the legal and medical professions.

As I have been asked to send a short reply to the paper, explaining the true meaning and benefit of such a bill, I take the liberty of asking first for your valuable advice as to what you think would be the best thing to say in a few words in answer to such a misleading editorial, and what would most influence the public to believe that such a movement is something more than making a "corner in plans."

You see, if the public — I mean the great masses outside of our profession — could only read the *American Architect* every week, it would not be long before a decided improvement would be noticed in public opinion as to the proper conduct of our profession. But, unfortunately, your editorials are like the good sermons of the preachers and reformers, which fail to reach the majority of those for whom they are most intended, because those are the very people who never go to church or anywhere else where they can hear good advice.

When the daily press is against us, it is hard work indeed to try and raise the standard of our profession in the community in which we live. Yours, ARCHITECT.

"The architects have perfected a bill which is expected to keep the planning of buildings in the hands of the fraternity. The cornering business must end somewhere." — *Editorial from Democrat and Chronicle.*

[IT would never occur to us to think the squib anything but feebly amusing and quite harmless. We do not believe there was any serious motive in printing it any more than there could have been much thought wasted in writing it. In cases of such a "grievance" as this, it would be our advice, every time, to let it alone. — EDS. AMERICAN ARCHITECT.]

LAMB & RICH *vs.* BLOOR.

NEW YORK, N. Y., October 22, 1889.

TO THE EDITORS OF THE AMERICAN ARCHITECT: —

Dear Sirs, — In your number of October 19, 1889, you give an account of a legal controversy between me and Messrs. Lamb & Rich. As you seem to have been misinformed as to the real nature of the matter, both as to the law and facts, I enclose herewith a copy of the pleadings in the matter, which fully explains the nature of the controversy. A. J. BLOOR.

[WE have read carefully the pleadings which Mr. Bloor kindly sends, but do not find anything which shows that the controversy was not described with substantial accuracy in our editorial note. Obviously, as the pleadings contradict each other, they afford no certain evidence as to the facts; the verdict will be the best indication in regard to these, if the unfortunate affair should be pressed to a conclusion. — EDS. AMERICAN ARCHITECT.]

NOTES AND CLIPPINGS

WIND-PRESSURE AT THE EIFFEL TOWER. — From calculations made concerning the resistance which the Eiffel Tower can offer, it is ascertained that it is able to sustain a normal wind-pressure of 881 pounds to the square yard, or a total pressure of more than 6,000,000 pounds, so that if at any time a hurricane of such unheard-of force should come to exert its force against it, the tower would bravely stand its ground, while in all probability most of the surrounding establishments in Paris would be demolished. — *Boston Transcript.*

A MOSQUE UNEARTHED FROM THE SAHARA DESERT. — One of the engineers on the Sahara Railroad, now being constructed by France, reports a discovery of great archæological value. Coming upon a mound of sand he had it dug into and found a dome, which proved to be the top of a tower, and, digging deeper, the tower proved to belong to a mosque entirely embedded in the sand. Continuing his researches he has uncovered nine houses and a water-course. The water-course is of great value, and will be used for irrigation. This discovery confirms the impression that the Sahara is another instance of the modification which climatic changes will effect and that it was once a populous land instead of the waste of desert we see it to-day. — *Exchange.*

MELTING ZINC. — Zinc is troublesome to cast, and more troublesome when small, thin moulds are to be cast. Lining the mould with whiting and water, which must be allowed to thoroughly dry, will often cause the metal to fill the mould well. Burning of the zinc (oxidizing) may be prevented by covering the metal, while in a crucible or ladle, with a layer of common salt, or a little muriatic acid, which amounts to the same, as a coat of zinc oxide is immediately formed on the surface of the melted metal, which effectually prevents further oxidization from action of oxygen in the atmosphere. It is an improvement to keep a layer of charcoal on top of the zinc, or any other soft metal which can be melted in a ladle. The coating of oxide forms a protection against oxidization to only a certain degree, while the layer of charcoal tends to reduce the oxide again to its metallic form. Indeed, it is possible to recover lead, tin, zinc and antimony from the "dross" or oxide which gathers in the ladle. It is only necessary to melt the oxide with charcoal, salt and soda to get it again into useful shape. The dross should be powdered; likewise the salt, charcoal and soda. Mix them together and melt. The soda and salt melt into a pasty mass, and the carbon unites with the oxygen of the dross, leaving the metal free, but burning off the charcoal. The salt and soda simply act as flux in reducing the oxides. — *The Northwestern Mechanic.*

COOPER UNION'S GREAT SCHOOLS. — The free classes in Cooper Union have opened for the fall term. Sessions of the day classes began at nine o'clock in the morning, and the night classes met at 7:30. All the classes are full, and the Trustees of the Union look forward to as fruitful a term as the institution has ever had. The staff of instructors, save for one or two changes, is the same as last year. There has been an unusual rush of applications for admission, and there are several thousand eligible candidates who have been denied admission owing to lack of room. The classes in the Scientific and Art Schools are complete with the following number of pupils:

Elementary mechanics	60	Arch. drawing	200
Astronomy	260	Elem. arch. drawing	100
Applied mechanics	20	Descrip. geometry	50
Analytical geometry	45	Mech. drawing	200
Dif. and int. calculus	45	Elem. mech. drawing	50
Trigonometry	60	Drawing from copy	400
Geometry	180	Decorative designing	180
Algebra	180	Drawing from cast	100
Natural Philosophy	300	Drawing from form	100
Geology	250	Perspective	80
Elem. chemistry	300	Modelling in clay	120
Chemical analysis	25		

Another class that has begun its daily sessions, one of the most interesting in the Union, was the Women's Class in Phonography and Type-writing. Fifty pupils form the complement of this department, and they are under the guidance of Miss M. E. Robbins, whose success with last year's class was so marked as to particularly attract the attention of the Trustees. There were about three hundred applicants for admission to this class, and the Assistant Secretary, L. C. L. Jordan, informed an *Evening Post* reporter that it was with great care and greater difficulty that the members had been selected. The Free School in Telegraphy for Women has also opened. In this, too, the number of pupils is fifty, and their instructress is Miss Annie F. Brown. The Women's Art School began its term on Friday. The discipline of the various classes is strict. Repeated absence or tardiness is not countenanced except under exceptional circumstances. Any pupil absent on three occasions without sufficient excuse is immediately dropped from the roll. — *N. Y. Evening Post.*

The First European Gallery of Casts. — The old characteristic houses of Vienna are being pulled down one by one, and the traditions attaching to them are fading, and will be utterly forgotten by the generation which is at present growing out of its teens. These old houses were for the most part known by a name, streets with numbered houses having formerly been uncommon. The autumn is the season for pulling down what is condemned to fall, because the foundations can be prepared during the winter, and in the newborn spring five-storied monsters, that darken the streets and conceal the blue sky, spring up as if by magic. This autumn, as in previous years, demolition is the order of the day, and a few days ago the bricklayer's spade struck the foundation-stone of the old Muller Haus. This old house is rich in historical associations. The house, which consisted of long galleries and spacious parlors, was built a little less than 100 years ago, by Joseph, Count Deym of Striletz, who, although he was of undoubted nobility, and proprietor of a feudal castle, was still proud to bear the title of Court Statuary to Emperor Francis of Austria. The story of this title is worth telling. He entered the army at eighteen, and being of fiery temperament, was soon involved in a duel. Having seen his antagonist fall, and believing him to be dead, he fled from his native country and sought refuge in Holland, where he called himself Muller, and professed to be an artist. He earned his living by embossing small portraits in wax on light blue glass, and in a few years time, having earned fame and money, he migrated to Italy. In Naples he soon found favor with Queen Caroline, an Austrian Princess, to whom he told his story. She obtained for him the permission first to copy in wax the finest sculptures of the Naples Art Gallery, and then to take plaster casts from them — the first that were ever taken. He returned to Vienna with a fortune of 300,000 silver florins, honestly earned, and promised to show his fellow-countrymen what formerly only the few favored ones who could travel to Naples could hope to see. Nobody believed him; but in good time 100 busts and statues, copied from the masterpieces of ancient Greece and Rome, arrived, transported from Naples to Vienna at great cost, and with wonderful patience. The Emperor gave him some good ground upon which to build a house with galleries, and after having inspected the valuable property conferred upon him the title of Court Statuary. Count Deym never took his family name any more, but called himself Joseph Muller to the end. All Vienna thronged to his show, and Count Deym made his galleries especially attractive by a new invention. He was the first to use glass prisms on his chandeliers, and with the aid of thousands of wax candles, earned for his house the name of a fairy palace. He gradually co npleted his collection by adding original works of art in bronze, marble and ivory, and a by no means inconsiderable number of oil paintings. He married a lady of ancient nobility, a Countess Buguoy, who did not call herself Muller. She and her three sons and four daughters took the name of Deym. In the foundation-stone revealed to light were found beautiful sculptured and tinted apples, pears and peaches, a saucer of old Vienna porcelain in which lay diverse crystal prisms, Count Joseph Deym's portrait in wax on blue glass, a beautiful piece of work, and very well preserved, and a large leaden tablet engraved on both sides, giving the history of the founder of the house, the Imperial grant and a detailed account of the uses to which the building was to be put. Besides these things a glass goblet was found, but a workman dropped it as he took it out, and it was shattered to fragments. There can be no doubt that the Count's portrait was his own work, as well as the prisms in the foundation-stone. The fact of his placing them there shows how proud he was of his invention. — *London News.*

How Paul Veronese Paid for his Lodging. — Protogenes, the Greek painter, was an impatient man. In painting a picture of a tired, panting dog, he met with satisfactory success, except that he failed in every attempt to imitate the foam that should have been seen on the dog's mouth. He was so much provoked over it that he seized the sponge with which he cleansed his brushes and threw it against the picture with the intention of spoiling it. It happened to strike on the dog's mouth, and produced, to the astonishment and delight of the painter, the very effect that he had labored so persistently to imitate. Paul Veronese, like many other painters, was given to eccentric moods and odd habits. On one occasion he accepted the hospitality of a family at their beautiful country villa. He assumed great liberties during his visit, claiming absolute possession of his room, allowing not even a servant to enter. He would not suffer the maid to make his bed, and the sweepings of the room were left every morning outside of the door for her to remove. He slipped away without bidding the family good-by. On entering the room the servant found the sheets of the bed missing, and at once reported that the painter must have stolen them. After careful search a roll was found in a corner, which proved to be a magnificent picture of "Alexander in the Tent of Darius." It was painted on the missing sheets of the bed, and the artist had chosen this curious way of recompensing his hosts for their generous hospitality. — *New York Star.*

The Sweet-water Dam and the Land-owners. — Although the Bostonians who built the Sweet-water dam near San Diego, Cal., probably do not particularly enjoy the thought of the amount of cold cash which that for the present useless structure represents, yet they may be imagined as indulging in a grim smile or two at the way in which they met the recent verdict of a jury in the San Diego Superior Court. The owners of the 350 acres of condemned land covered by the reservoir had been awarded damages by the courts, but were not satisfied with the amount, and carried the case up. The jury in the Superior Court, the company claims, valued the land according to its prospective worth, and gave the plaintiffs a verdict for $122,675 or, say, about $322 an acre. Thereupon these sharp and hungry gentlemen rejoiced. But a telegraphic message flashed across from Boston, the floodgates of the dam were opened, the 5,000,000 gallons of water ran into the bay, and the company's agent remarked, in effect, to the claimants: "We would not deprive you of your land. There it is again. Take it." So their joy has been turned to sadness, and they find that by their greed they have not only lost a fair profit on their land, but injured the whole town of San Diego by cutting off a goodly portion of its water-supply. — *Fire and Water.*

English Praise of American Architectural Journals. — "In that room [the R. I. B. A. Reading-room] may be seen daily no less than seven illustrated journals of architecture and building published within the bounds of the great Republic of the West; and, possibly with sarcastic views, it has long been the custom to compare the progress of the Australian colonies with that of the United States. The seven journals from America, as all who come to the Institute may read, are not mere 'specimens' of Colonial or Western enterprise, but are journals whose managers conduct them as if to the manner born, and many of the illustrations in most of them surpass those of the British." — *Journal of Proceedings R. I. B. A.*

Repairing Terra-Cotta. — In the handling and re-handling of terra-cotta, of all kinds, it is liable to be chipped or broken, especially on the corners, where it is to be joined to some other piece of the architectural design. When this happens, it is best to examine the broken part, and if it has a slant outward or inward take a sharp chisel and light hammer and make saw-teeth indentures in the sharp part of the break, and then when it is in position point up the place with a cement composed as follows, which will gradually indurate to a stony consistency: Mix 20 parts clean river sand, 2 litharge and 1 of quick-lime, into a thin putty with linseed oil; if for red terra-cotta, color to the desired shade with Venetian red; if buff, with yellow ochre; if brown, with Spanish brown. The cement should be made all at one time, and the pointing up should also be so done as to avoid a variety of shades. When this kind of cement is applied to mend broken pieces of terra-cotta, or to mend broken pieces of stone, as platforms, or exterior or interior steps, it acquires, after some time, a stony hardness. A similar composition has been much used to coat over brick walls, under the name of "mastic." — *The Brickmaker.*

TRADE SURVEYS

The tendency to buy more and more in manufacturing circles continues. Consumers seem to fear that prices may advance. Everything which throws light on that question is read. The danger, if there is a danger, can be guarded against by and through a proper understanding of the whole industrial situation. Economists have often pointed out that there were very poor grounds for the sudden expansion and advance of prices, which have disturbed healthful commercial conditions in years past. They have shown that the wild rush for supplies created speculative values, only to be followed by long reactions. Business men who have no time for essays and no regard for theories, judge by a few surrounding conditions what is best to be done. In every industry and channel of activity, a sort of inventory of capacity and demand is now being taken with a view of arriving at a practical conclusion as to what had better be done. These surveys are necessary in the present condition of commercial affairs. There is a readiness among manufacturers in every line to invest money and expand capacity, but the question they are asking is, What is wanted? The consumption per head of population of a long list of manufactured products is known, and capacity is kept as nearly as possible within those limits. Hence it is that commercial interests are more wisely and conservatively managed, and that the percentage of losses, as compared to the total volume of business, is declining. The contractors and builders unite in saying that this season's business has, on the whole, been the most profitable of any. In the four cities of Boston, New York, Philadelphia and Chicago, the expenditures for building purposes will, in the aggregate, it is computed, fall very little under one hundred and fifty million dollars. The greatest activity has been maintained this year in the smaller cities and towns. Reports from these places are not easily obtained, and are, at best, but fragmentary, but so far as information from reputable sources go, it shows that there has been an extraordinary outlay of money for house, mill, factory and shop construction.

The decentralization of industry is going on at a galloping pace. Equalized rail charges, no doubt, contribute to this condition. The springing up within two or three years of possibly two or three thousand new centres of industrial activity has had a more potent influence in strengthening and expanding business than the construction of ten or twenty thousand miles of railroad. This rapid multiplication of little industrial centres will continue and will constitute the great and characteristic feature of American progress for years to come. New England will not monopolize cotton-goods manufactures or paper-making, nor Pennsylvania in iron-making. Breaking up of industries as regards location has set in, and the forces at work will erect great industrial communities where at present there is not a sign of life. Economical forces and unwritten laws will create a condition of things in this country nowhere else known. Cloth-mills and blast furnaces will be built side by side. In fact, this departure is seen in Pennsylvania, where Paterson silk annexes are built now under the smoke of blast-furnaces. Architects who speak of future probabilities are very confident that, unless strikes occur, as much building will be done next year as this. Iron and steel makers are nearly all preparing to enlarge their plants or build new ones. Last week, the announcement was made in Cleveland and Chicago that four new boat-yards would be started. West of the Mississippi, a vast amount of railroad and bridge work is in contemplation, and, as it is projected by wealthy railroad corporations, it will likely be done. The rush of small shop and factory orders, which has kept up since September 1, will not abate, as stocks of raw material among manufacturers and wholesalers are almost an unknown quantity. This, in fact, is the strongest feature of the entire business situation. Not only is there no accumulation of stocks, but high authorities doubt whether we have wheels and hammers enough to keep the country going with products. On the heels of this doubt comes the inquiry, asked too frequently of late: "Is there money enough?" If there are serious dangers lurking they will not take the country by surprise. Trade and manufacturing and commercial organizations are stronger than they ever were, and each and all are working towards more clearly-defined objects.

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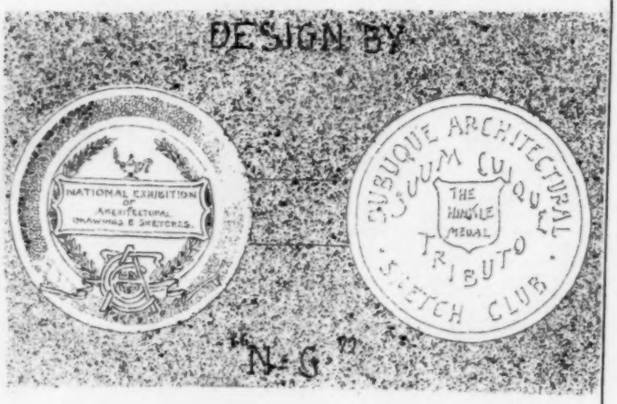
"Acropolis"

FACE

BACK

REVERSE

SUBMITTED BY "Lichten-stein"



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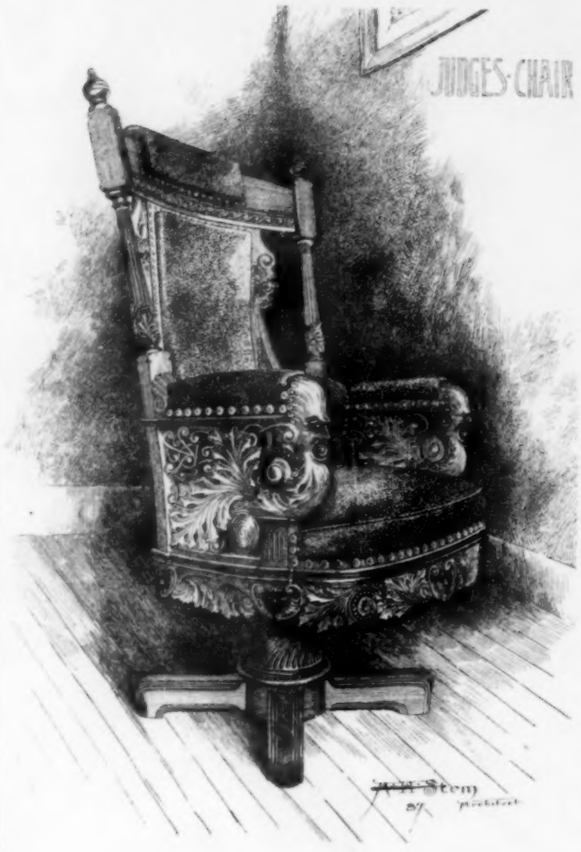

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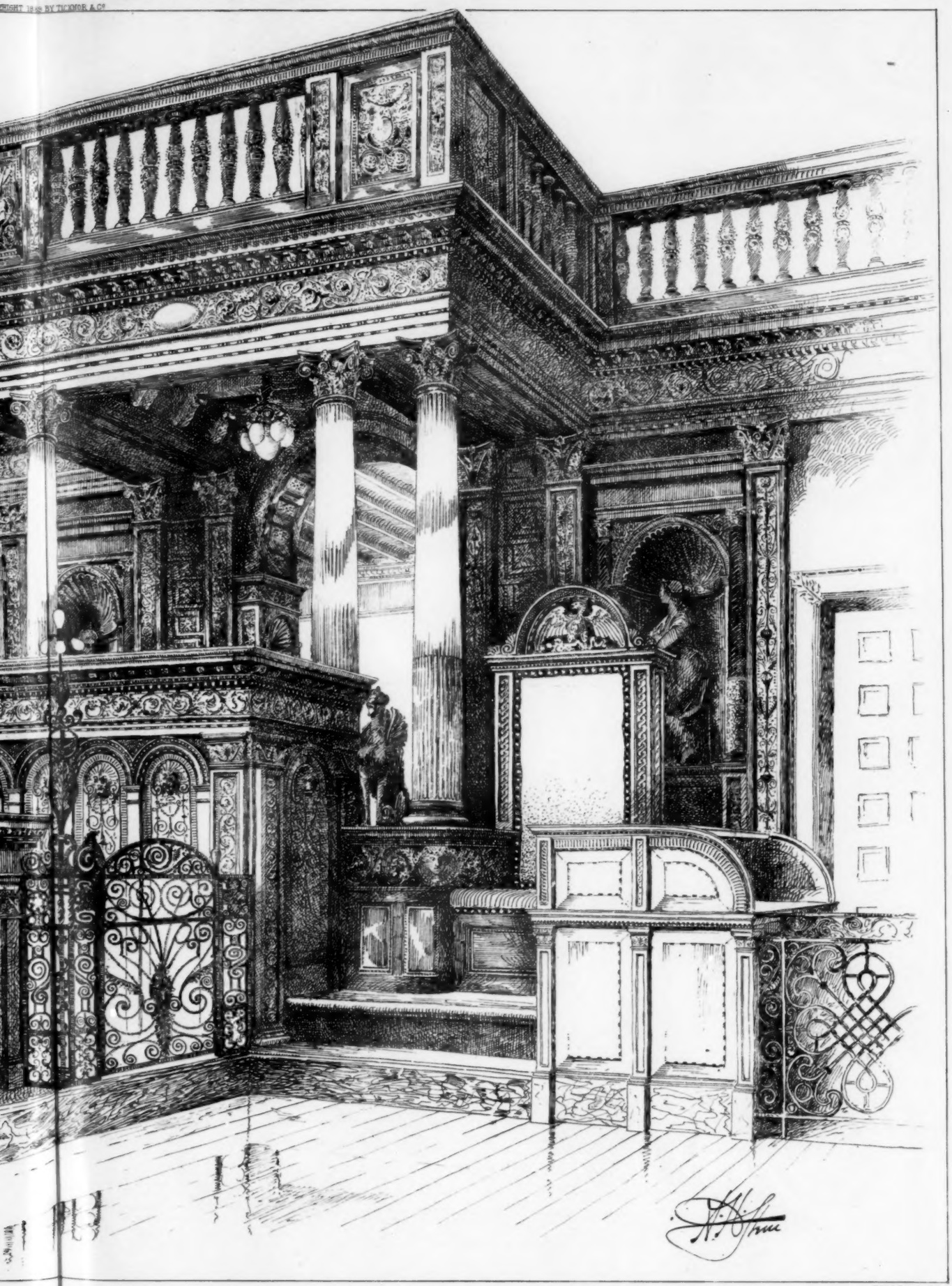

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